purely theoretical formulæ. This promise is of course not rigorously carried out, as we find the calculus is used throughout, while the formulæ involve elementary algebraic knowledge on the part of the users. We are very glad indeed to see such a book produced, tending to remove the atmosphere of mystery from calculations.

CONTINUOUS CURRENT DYNAMOS AND MOTORS. Their theory, design, and testing, with sections on indicator diagrams, properties of saturated steam, belting calculations, etc. An elementary treatise for students. By Frank P. Cox, B.S. New York: The W. J. Johnston Company, Ltd. 1893. Pp. 271. Price $2.

The specialization of dynamo work is illustrated in this contribution, where all the calculations are kept down to the practical ones required in constructing the machines. It will be found a most excellent contribution to the subject, and one in line with the work reviewed in the preceding notice.

PRIMER OF PHILOSOPHY. By Dr. Paul Carus. Chicago: The Open Court Publishing Company. 1893. Pp. vi, 232. Price $1.

Philosophy in this book is treated of from the standpoint of experience. Experience by the writer is made the sole base of philosophy. The methods of philosophy are said to be derived from experience and the problems of life are to be solved by the methods of philosophy. This is the abstract of the scheme of the work.

PRACTICAL DYNAMO BUILDING, WITH DETAIL DRAWINGS AND INSTRUCTIONS FOR WINDING. By L. C. Atwood. St. Louis: Nixon-Jones Printing Company. 1893. Pp. vi, 143. No index. Price $3.

The title of this book exactly describes its contents. It consists of a description of a number of dynamos, the details of construction of each one being given without any attempt to theorize. At the end of the book are given appendices of tables, underwriters' rules and regulations for wiring, and a chapter on how the electromagnet is produced, another on the history of electricity and the electric light, and one on the incandescent system, and a final one on the economy. The lack of an index is a bad feature.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5666) **M. T. asks: 1. What is the best** way to leave boilers that have been using salt water and now are not to be used for several months? A. If there is any fresh water to be had, the boiler should be thoroughly cleaned out and washed out with fresh water, then filled with fresh water and steam got up, a few pounds pressure, and air blown out at the safety valve; the boiler pumped full of water while steam is on, allowing the safety valve to be blown enough to get rid of all air inside of the boiler; then close all valves and cocks on the boiler to keep out air. The airless water will preserve the inside of the boiler from rust. The flues and shell should be thoroughly cleaned. 2. I have two tandem compound engines, working with 100 pounds steam pressure. I would like to know if it would not be more economical to run the pressure down when I have only half load, *i. e.*, would I not get better work from the low pressure cylinder if the high pressure were to carry the steam longer and exhaust into the receiver as a higher pressure, thereby making the low pressure piston do more work? A. You have only to set the cut-off to suit the work required; or, if the load is variable during the day or night, throttling by the steam valve is preferable. This may vary the relative work of each cylinder; but as the vacuum may be constant under the varying conditions, there can be no material loss of steam, whether less pressure is carried in the boiler or the cut-off carried back; but probably both are advisable in our uncertainty as to the present position of the cut-off. 3. Why is zinc used in boilers using salt water, and what is its action? Is it a benefit or not? Is there any substitute? A. Zinc is used for removing scale by its galvanic action, its proper connection being by copper wires with the stays at the top of the boiler. 4. If I were to run a 100 horse power engine with 100 pounds steam, and only have 25 horse power of work, would not the low pressure piston form a vacuum on the steam side, owing to the other cylinder cutting off so early with the high pressure, thus making the low work against the high pressure cylinder? A. There should be no vacuum in the low pressure cylinder until the cut-off has been reduced to one-tenth and under, and then only a partial vacuum at end of the stroke. There is no harm in this practice for a tandem compounded engine. 5. Please state at what pressures I should carry the steam to get the best results. Both the engines are working with about 26 inch vacuum. A. The most economical pressure for running a tandem compound condensing engine cannot be stated without a knowledge of its proportions; but assume that 60 pounds pressure and a proper change in the cut-off will be your best practice. 6. How much economy is there in a slow speed Corliss engine over the high speed class? A. The economy of slow or high speed is mostly in the wear of the engines and their size. For engines of 100 horse power, 100 revolutions per minute is the best speed.

(5667) **J. A. asks: 1. Can I enlarge the** small motor described in SUPPLEMENT, No. 641, to one-half horse power? A. You can, but it is better to follow SUPPLEMENT, No. 844. 2. How can I make the one described in No. 600 small enough for one-half horsepower? A. As the size given is a little less than a horse power, it will answer probably as it is. Or you may reduce its dimensions in the ratio of the sixth roots of 1:2. (See answer 5, below.) 3. How many storage cells will it take to run the last named motor as one-half horse power? A. Twenty-five. 4. Can I charge the same with gravity batteries? A. Yes, if you allow enough cells of gravity battery. A series of ten gravity cells will charge four storage cells, but very slowly. The series of gravity cells may be parallelized to increase the rapidity of charging. 5. If not, can you tell me where I can get directions for making one-half horse power motor? A. A very slight reduction in size (about 98:89, or $\frac{9}{10}$ the dimensions of No. 600) will be right. The size of wire and number of turns depends on the voltage to be employed. Calculate as if for a dynamo. Calculations will be found in Sloane's "Arithmetic of Electricity." $1 by mail.

(5668) **G. R. C. asks: 1. Does combustion** in common air vary in rapidity in proportion to pressure; *i. e.*, for instance, would a fire burn half as fast in a one-half vacuum or four times as fast in compressed air, at a pressure of 60 pounds per square inch, as it would at common pressure of 15 pounds per inch? A. No exact experiments have been made determining any ratio between the rate of combustion and the density of the air fed to any kind of fire. The result will vary with the combustible; but the combustion increases faster than the pressure with many combustibles; that is, within certain limits. 2. Please to inform me at what temperature or pressure hydrogen gas is liquefied. Is oxygen liquefied at same temperature? Also at temperature of 212° F., what pressure is required to liquefy CO_2? A. Hydrogen is known to have been liquefied. Oxygen has been liquefied by several chemists, among them Pictet, Cailletet and Hautefeuille, Wroblewsky, Olszewski, and Dewar. Olszewski determined the boiling point, which is close to that at which it begins to liquefy, 294½° F. below zero. The liquid oxygen has, at this temperature, a maximum density of 1·137. Wroblewsky cooled it to 392° F. below zero, without solidification. At 212° F. carbon dioxide cannot exist in the liquid form. Andrews discovered, some thirty years ago, that what is called the "critical point" of carbon dioxide is as low as 87° F. At this point it begins to gasify gradually, under any pressure, and at a few degrees higher passes wholly into a transition state, independent of pressure. For valuable articles on the liquefaction of gases, we refer you to our SUPPLEMENT, Nos. 489, 896, 878, 932; also SCIENTIFIC AMERICAN, No. 2, vol. 67, and No. 11, vol. 68.

(5669) **S. A. D. asks: 1. Should the** shutter in a detective camera be in a certain place, or will it give good results in the rear of the lens inside of the box? A. A shutter placed between the lenses is supposed to be in the best position; but practically it makes no difference whether it is placed in front or behind. 2. Is it necessary to have the aperture in the shutter the size of the lens, or would it work the same if it were as large as the largest stop in taking instantaneous exposures? A. It is advisable to have the aperture in shutter fully as large as the lens opening, in order to obtain the advantage of all the illumination.

(5670) **C. E. P. says: The inclosed piece** of wood I broke from a common split basket that was used for holding clothespins, the same being frequently set in the yard during the summer season on wash day. Will you kindly explain whether it is larvæ or excrement, and from what kind of an insect? Reply by Prof. C. V. Riley.—The flattened, ovoid objects attached to a bit of wood broken from a split basket, the one overlapping the other, are the eggs of one of the common katydids. This is the angular-winged katydid (*Microcentrus retinervis*), which is found throughout the South and West. It feeds upon the foliage of various plants, but is not abundant enough to be specially injurious. These eggs have been variously referred to different insects by older authors, and their true nature is fully set forth in an illustrated article in the "Sixth Report on the Insects of Missouri." The first notes of this katydid are heard about the middle of July, and are made by the male, the wing covers being partially opened by a strong jerk and the noise produced by the gradual closing of the same. The song consists of a series of from 25 to 30 raspings, as of a stiff quill drawn across a coarse file, and strongly recalls the slow turning of a child's rattle, ending by a strong jerk of the same. The female responds by a single sharp chirp or tschik. The young katydid issues from the egg in early summer, but leaves little evidence of hatching, as it issues from the side and the two parts of the shell contract again. There frequently issues instead a characteristic little parasite (*Antigaster mirabilis*, Walsh), which gnaws a smooth round hole, about the size of a large pinhead, through the shell.

(5671) **J. L. says: I have two large mir-** rors which are spotted; *i. e.*, the quicksilver is coming off in spots. Is it caused by roaches or what? Have you a receipt of any kind that I can use on them to advantage? A. Remove the silvering from the glass around the scratch, so that the clear space will be about a quarter of an inch wide. Thoroughly clean the clear space with a clean cloth and alcohol. Near the edge of a broken piece of looking glass mark out a piece of silvering a little larger than the clear space on the mirror to be repaired. Now place a very minute drop of mercury on the center of the patch and allow it to remain for a few minutes, clear away the silvering around the patch, and slide the latter from the glass. Place it over the clear spot on the mirror, and gently press it down with a tuft of cotton. This is a difficult operation, and we would advise a little practice before trying it on a large mirror.

(5672) **N. A. C. asks: What is the pro-** per and quickest way to tell whether a glass fruit jar is air tight? A. At the time of putting up fruit in glass jars the jars should be turned neck down while hot, when if not tight air bubbles will be seen rising among the fruit through the sirup as they cool. After fruit has been put away in glass jars any leakage of air will create mould on top or cause the sirup to ferment.

(5673) **A. W. S. asks for a good recipe** for belt glue; something that does not require more than four hours to dry and will hold after it is dry. What is "Buffalo frozen glue"? A. For a good, quick-setting glue for belts, select the best amber-colored glue that can be found and test its toughness by baking the pieces, which, if of good quality, will bend and spring back, and finally break with a splintered edge. Make up the glue in the usual way by soaking cold and then heating. For a pint of thick glue prepare an infusion of gall nuts (strong) and add half a gill, hot, to the pint of hot glue just before using. Use quickly, with good wooden clamps to press the belt laps close. The tannic acid properties of the gall nuts make the glue elastic and tough. The "Buffalo frozen glue" is made by freezing the glue gelatine as soon as sliced, causing it to become spongy in drying.

(5674) **R. J. L. asks: How can canvas or** duck used for wagon covers and for belts be treated so that it will not be eaten or torn by mice or rats, and at the same time leaving the canvas uninjured? A. Soak or wet the canvas and belts with a strong solution of alum in water and dry; or, if the color is no object, wet the goods with a decoction of wormwood or aloes.

(5675) **G. W. S. asks: What will remove** stains on cotton cloth produced by a toning solution? The solution is that sold by dealers, which had been used until yellow. A. First try boiling the cloth in an ordinary clothes boiler for half an hour, then set out in the sun to dry and bleach. If this does not succeed, moisten the cloth with warm water until it is thoroughly softened; then try rubbing the stain with a dilute solution of nitric acid, one-half an ounce, mixed with twenty ounces of water, rinsing the cloth in warm water after each application.

(5676) **G. D. C. writes: I wish to light a** small sleeping room a half hour each night in week with an Edison six candle power lamp, incandescent. How may I make primary and storage batteries with quart and pint cells, which I have at hand? What number of each and how arranged for lighting above lamp; also how connected? A. You will need twelve volts and one and a half amperes. A six cell plunge battery, such as described in SUPPLEMENT 792, connected in series will answer. Be careful never to leave the plates immersed except when using. Storage batteries are described in several of our SUPPLEMENTS, but we do not advise you to try to make one yourself.

(5677) **S. G. M. writes: I have a one** horse power motor of 500 volts running in my shop. The power is furnished me by the street railway company. I would like to burn some incandescent lamps in my place, the electricity for these to be furnished by batteries; storage batteries I suppose to be the most preferable kind. Could I charge those batteries from that motor while it is running and driving my machines? How many batteries would it require for four, eight, or twelve lights to burn at an average one to two hours a day? What voltage would those lights require? How much more power does the motor require in order to charge the batteries and run my machines? Understand, while I have a one horse power motor, I hardly use over one-half horse power when running, or rather don't need more than that. What other batteries can you recommend, outside of the storage system, to burn four or eight incandescent lights? Will they last (the batteries)? Can you advise me how to arrange the batteries for said purpose? A. If your motor uses only 1½ amperes of current, you will have slow work charging a storage battery. For twelve 16 candle power lamps of 24 volts each, allow 13 cells of storage battery. If you run them two hours, the battery at the rate of 1½ amperes will require thirty-two hours to be charged again up to the starting point. If you run them only one hour, half the given number of hours will be spent in the charging. The charging will absorb about 30 volts, representing, at 1½ amperes, one-fifteenth horse power. The batteries will last a long time, with careful usage. We do not advise the use of primary batteries. Arrange batteries in series. Consult our advertising columns for addresses of electric supply firms.

(5678) **B. B. W. asks: 1. What is the** voltage of a single storage battery cell? A. Two volts on the discharge. Two and a quarter volts are required to charge it. 2. How many cells will it take to run fifteen 16 candle power 110 volt lamps for ten hours? A. Fifty-six. 3. How many amperes of current will that amount of cells require to run said amount of lamps, and how large will they require to be? A. 6·75 amperes, requiring rather more than one foot area of positive plate. 4. Have you a book on storage batteries for good practical use in lighting? A. We can supply Salomon's "Electric Light Installations and Management of Accumulators," price $2; Reynier's "Voltaic Accumulator," price $3 mailed. The first named is exceedingly practical.

(5679) **R. M. P. asks: 1. Can you ad-** vise me, at earliest convenience, the object of evaporating oil to burn the gas, in lieu of burning from a wick, in the "gas-generating" devices being introduced in stoves, etc.? A. More rapid combustion, with greater freedom from smoke, is obtained. 2. Is anything gained in increasing the temperature of the gas before ignition? A. This is a gain in intensifying the heat, and if waste heat is employed, an absolute gain may be reached. 3. Is anything gained by increasing the temperature of the air (that joins the gas) before it reaches the gas for combustion? A. The same applies, but in a much greater degree. Air, however, is hard to heat, as it is very diathermic. We recommend as authorities on heat the following books, which we can supply by mail at prices given: "Thermo-Dynamics, Heat Motors, and Refrigerating Machines," by De Volson Wood, price $4; "The Principles of Thermo-Dynamics," by Rontgen, price $5; Peabody's "Thermo-Dynamics of the Steam Engine," price $5 mailed.

(5680) **E. R. A. asks: 1. What sizes,** lengths, and weights of insulated wire (copper and German silver) will be necessary to produce following resistances: 1 ohm, 9 ohms, 40 ohms, and 150 ohms? The wire is for tangent galvanometer described in "Experimental Science." A. Consult a table on resistances of wire. These are given for copper wire, and you may multiply the given resistances by 13·1 to get the resistance of corresponding sizes of German silver wire. Only an approximation can thus be obtained. See Sloane's "Arithmetic of Electricity," page 128, $1 by mail. 2. What weight and length of No. 40 insulated copper wire

to produce 150 ohms resistance will be necessary for reflecting galvanometer described on page 434 of "Experimental Science"? A. This wire is exceedingly fine and needs great care in working. One hundred and forty feet will give approximate resistance desired; 33,333 feet weigh one pound.

(5681) W. B. S.—Answer by Prof. C. V. Riley.—The insects sent are the male and female of the common wheel bug or "devil's coach horse," as the species is called by children in the South, *Prionidus cristatus*, Fab., referred to in most of the older treatises on insects as *Reduvius novenarius*. It is a very common predaceous insect throughout the Southern States, but I have never known it to occur as far north as New York City. Was it collected by Mr. Sargent or was it sent to him by a correspondent? The eggs of this insect are laid upon the bark of trees, the sides of buildings or on fences, and resemble little leather bottles standing on end and side by side in groups of a dozen or more. The young wheel bug, when it first hatches from the egg, is distinguished by a bright crimson abdomen, which it erects in such a way as to give it a threatening appearance. Upon reaching full growth and acquiring wings it becomes a uniformly dark gray color, resembling in general the color of the bark of a tree. It lives upon caterpillars, grasshoppers, and other soft insects, and its strong beak enables it to pierce even a hard-bodied insect. It captures its prey by stealth, as it is a slow and awkward creature.

(5682) W. S. E. asks: 1. Will you kindly inform me how much hydrogen gas will be liberated by the consumption of one pound of zinc in sulphuric acid? A. Two sixty-fifths pound, measuring about 10,000 cubic inches. 2. Would gas so made be as suitable for use in a gas engine as ordinary illuminating gas? A. It would answer, but would be very expensive. 3. What proportions of such gas and air would give the most explosive mixture? A. Two volumes of hydrogen to five of air.

(5683) K. F. asks: Will two ounces of No. 33 cotton-covered wire produce a stronger electromagnet than No. 24 cotton-covered wire, same amount of wire? A. No general answer can be given. It all depends on the conditions. At maximum capacity, with similar cores and potential to suit, the power would be equal.

(5684) N. N. asks (1) how to find about the right time of day by a compass when he knows the longitude. A. For such problems we refer you to Gillespie's "Surveying." 2. Winding an electric motor, say ¾ horse power, to a 110 volt circuit, it would take about 187 watts; the total resistance would be about 64 ohms, if series wound; the field magnet a little less resistance than armature, say field 26 and armature 38 ohms, 26+38=64. If shunt wound, the field magnet would be 14 times more than armature; but as the circuit is divided in two, I don't nnderstand how much resistance field and armature could have to make its total resistance 64 ohms. A. Make your field of resistance sufficient to keep the current within safe limits for the wire used, or make it so as to pass the desired current, giving a resistance in this case of 64 ohms. The winding of the armature is based on the desired speed, not on the resistance. Enough turns must be contained to generate counter electromotive force enough to keep the speed down. In other words, it must be wound so as to generate 110 volts at the maximum speed. Calculate as if for a 110 volt dynamo. 3. One pound of water decomposed into oxygen and hydrogen. What explosive power has it in comparison to common dynamite? A. About 37 atmospheres or 550 pounds per square inch of pressure is given by the exploding gases, about $\frac{1}{1855}$ the power of 75 per cent dynamite. 4. How long a time will it take to decompose one pound of water by a dynamo capable of giving a current of 10 amperes and 6 volts? A. One ampere will decompose 92 micrograms of water per second at 32° Fah. and standard barometer. This is 0·00073 pound avoirdupois. If you use three decomposing cells in series it would give three times this quantity at 10 amperes. 5. About how many vibrations does the armature of an induction coil like the one described in "Experimental Science" make per second? A. 200 to 500 per second. 6. Have you a book about practical geometry, plain and practical for a beginner? A. We recommend and can supply at price given by mail: "First Steps in Geometry," price $1.25; "Plane and Solid Geometry," by Bowser, price $1.75.

(5685) F. F. M., Newton Falls, Ohio, says: 1. Many wells here are dug to the rock and then drilled through the rock, the water rising several feet in the dug portion. What causes the water to become soily before a storm? Soundings show that it is not low water. A. The nature of the soil and methods of finishing the wells should be known to properly assign a reason for the stated action of the wells. It is well known that barometric changes in the pressure of the atmosphere affect some wells. Many blow or draw air and have a disturbance in the water level. As the soil above the rock is subject to water soakage, a change of level in the water by change of air pressure may cause a circulation into and from the soil, carrying the loam into the well. 2. What can be used as sizing or paint for the inside of soft or hard wood pails, so that they will hold gasoline or benzine? A. Coat the pails with glue having 10 per cent of glycerine, all boiled to consistency that will allow it to be elastic when cold. Apply hot with a brush. 3. Does steaming second growth hickory to hasten seasoning injure the wood or make it less valuable for stone cutters' mallets? A. Steaming will not injure the wood, but second growth or young hickory makes poor mallets. Oak is better. 4. Is there any other way to hasten seasoning without detriment to the wood? A. Slow air seasoning in logs with the bark on is best.

(5686) L. C. K. writes: I would like to know the efficiency in foot pounds of the best forms of the steam injector, as ordinarily used in supplying steam boilers with water. That is to say, for a given amount of work performed, will the injector compare favorably or otherwise with a compound or triple expansion steam engine? Or to put it in another form, supposing an injector performs 10 horse power per hour work, what amount of coal per horse power per hour would it require to do the work? A. The efficiency of the injector cannot be stated as a positive amount, from the various conditions of their use. The exhaust injector may be safely quoted on the positive side of 100 per cent, for it not only derives its power entirely from the waste heat of the engine, but also puts the water into the boiler at the usual temperature from other injectors, and when a heater is also used is equal to adding 150 heat units for each pound of water sent to the boiler. The ordinary injector takes from the boiler more heat units than it returns by the amount of radiation and leakage. Its efficiency may be from 90 to 95 per cent. It cannot be compared to a steam engine, even of the best type, which returns no more than from 16 to 18 per cent of the work value of the steam received from the boiler. As a pound of good coal is equivalent to 330 horse power, in heat units, per hour, the 10 horse power injector will represent 1-33 of a pound of coal per hour theoretically or without loss of any kind.

(5687) F. B., Naples, Italy, writes: In all the books treating the dried fruits I read that it is better for a great deal of reasons the fruits be dried with evaporators or other similar means instead to be dried in the sun. Will you kindly let me know through your respectable columns of the SCIENTIFIC AMERICAN your opinion about this question, since I know there are several American firms which have contracts here for dried cherries which must be dried in the sun. A. In all countries having a moist climate or cloudy and rainy weather at the fruit-drying season, a whole crop may be ruined or injured by a few days of bad weather, so that on any extended scale of business the use of evaporators becomes a necessity in the United States and some parts of Europe. In the sunny climate of Italy and the East the dry air and long terms of cloudless skies, as also old custom, has given the sun-dried fruit a reputation, which is no doubt at the bottom of the preference for that method by American fruit houses. We have never seen finer fruit, either in appearance or flavor, than is produced by the artificial driers in the United States.

(5688) M. S. Y. asks: 1. In the small Gramme ring motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 783, would not any very soft iron do, instead of Norway iron, for the field magnet? A. Any iron will do. 2. What size wire is to be used on field magnet? A. No. 20. 3. Would solder make a suitable Babbitt metal, and is sheet brass fit for commutator springs? A. Solder would not answer. Use copper for commutator brushes. 4. What horse power does the motor develop? A. It has never been computed. It is a very small fraction. 5. Can the parts be enlarged so that it will run a sewing machine for light work? A. They can, but we do not recommend it. 6. How many cells of plunge battery would be required to run a sewing machine? A. Six or eight cells.

(5689) T. W. S. asks: What size and shape of nozzle will give the greatest power under an 80 foot head, using an 8 inch pipe which is 120 feet long? Would there be any change in nozzle if the head were 100 feet, with pipe 170 feet long? What horse power should we get at 80 feet head? A. The nozzle should be slightly taper, after the form illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, 3½ inches diameter, which will give you a spouting velocity of over 4,000 feet per minute, and if applied to a 6 foot Pelton wheel should furnish an available 45 horse power. With the longer pipe and higher head a 3 inch nozzle will give best results and about the same power.

(5690) H. T. asks: How high ought a pump lift water at an elevation of 8,000 feet? What is the difference for each 500 feet from sea level up to any height? How many inches of vacuum will an air pump maintain at 8,000 feet, and what is the difference for each 500 feet? A. The loss in pump lift at an elevation of 8,000 feet is 9 2-10 feet with the barometer at mean pressure, or a little over 27 per cent. Assuming the lifting height of ordinary pumps at sea level to be 28 feet, 21½ feet would be the lift at 8,000 feet elevation. The variation is not a constant for each 500 feet elevation. It is a decreasing ratio. The loss of lift at 500 feet is 1·017 feet, at 1,000 feet 1·64 feet, at 2,000 feet elevation 2·84 feet.

(5691) G. A. L., Mont., says: I want to pipe a small spring 6,000 feet away, having a fall 40 to 50 feet. What proportions of pipe would give the strongest flow, ending with half inch, and would it produce any power? A. The flow of water for long distances through small pipes is of no practical value for power, as the friction absorbs most of the value of the head. With a division of the distance into three parts, with 1 inch, ¾ inch and ½ inch, will give an open flow of 1½ gallons per minute, from which no power of any value can be obtained with the low head stated.

(5692) L. G. asks: 1. What change is necessary in motor No. 641 to run on a 110 volt circuit? A. Wind field with 4 pounds No. 25 wire. It would be better to use 5 pounds if you can get it on. The winding of the armature depends on the speed you desire. For a high speed use No. 32 wire on the armature, using the full quantity specified in weight. Finer wire will reduce the speed. 2. Can I make the armature of sheet iron washers with paper between each sheet in place of iron wire? A. Yes. 3. How can I make lard oil out of old lard? A. Purify the lard as far as possible, and extract the oil by hydraulic pressure of 1,000 pounds per square inch, the lard being contained in sacks.

(5693) T. S. R. asks if the brush holder (not the brush) of an electric street car motor were to touch the commutator of the armature, would that necessarily "ground" it? A. If the brush holder of the ground brush did this, it would make a ground; if of the trolley brush, it would make a short circuit. It is not easy to see how any such contact could be brought about except by a piece of metal bridging the interval between brush holder arm and commutator.

(5694) W. H. writes: 1. I have made the small hand power dynamo given in SUPPLEMENT, No. 161, and although it seems to give quite a strong current, it will not run a No. 3 Porter motor with 3 pole armature. Can you explain why I run the Porter motor with 6 cells plunge battery and it gives good satisfaction? I have tried the dynamo on a call bell, and it will ring it louder than the 6 cell battery. Can you tell me whether I can wind the motor so that the dynamo will run it, or wind the dynamo differently? A. It is all a matter of resistance and potential being properly related. We presume that the Porter motor is of too high resistance. Slightly finer wire on the dynamo might effect the purpose. But it may be the other way. 2. How many storage cells will it take to run the Porter No. 3 motor, and how long will they run it and give as much power as the 6 cell plunge battery? The plunge battery cells have 4 carbons, such as are used in a compound Fuller battery and compound Fuller zinc. A. A storage cell will give 2 volts potential and 10 to 35 amperes, according to size of current, for 10 hours. Two cells should run the motor for a number of days. Five storage cells would give about the same voltage and five to ten times more current than the plunge battery on low resistance. It depends on the size of the cell used. 3. Can I make a plunge battery with less cells and larger plates that will run the motor as well as the six? A. We have no data as to your motor, and cannot answer the question intelligently. Possibly a large two or three cell plunge battery would run it. 4. How many storage cells would it take to run five or six 16 candle power lights for three or four hours per day, and how much current would it take to charge them? How large a dynamo and how much horse power if the dynamo were running eight or ten hours per day? A. Allow 60 cells and on charging 1-20 horse power dynamo of 135 volts potential.

(5695) A. B. C. writes: I have just received a splendid Charcot compound magnet. What must I do in order to maintain its present strength? I have heard that it is not good to detach the armature suddenly, yet I would like to do that very thing, for I want to test its strength by adding weight to the armature until it is pulled off? A. Detaching the armature suddenly does no harm. It is the replacing it with a click or jar that injures the maguet. Slide it into place most carefully, and when you pull it off, do so sharply and clearly, so as to prevent any click or jar. Always keep its armature in position when it is laid aside and not in use.

(5696) B. T. S. writes: 1. I am thinking of making a pocket storage battery to last five hours without recharging it, and I would like to know if one gravity battery would be sufficient to charge it. If not, how many would be required, and how long would it take to charge the storage battery? I have some salt batteries which I run on my telegraph line and are as powerful as a gravity battery. I would like to know whether or not they would charge as well as gravity, if so, how many cells would be required? A. Three gravity cells in series will charge your storage battery. How long depends on its size; probably the same time will be required to charge as to discharge. The salt batteries will not answer, as they will polarize too quickly. 2. I have a very powerful magneto-machine, and I would like to know if it would run a one candle power incandescent lamp. If a number of these machines were joined in series, do you think it would light a miniature arc light? A. You can try your magneto on a lamp, but we are certain that it will not light unless specially built to give plenty of current. The effect of joining in series depends on the winding of the armature. 3. How much wire and what number should there be on the receiver of a telephone and state how to make one? A. Use No. 36 wire wound to 80 ohms resistance. See our SUPPLEMENT, No. 142, 10 cents by mail.

(5697) Sister C. asks: Why should the ocean be coldest at the bottom? Why should the Red Sea be warmer than Indian Ocean? A. The waters of the oceans are at the greatest density at a temperature of 39° F. The difference in density causes the warm water at the equator to flow toward the poles on the surface of the ocean, while the return current from the polar regions flows toward the equator along the bottom of the ocean by its greater density. By the great heat of the sun the surface water of the equatorial regions becomes warm, and flowing away toward the poles, allows the cold water at the bottom to gradually rise to the surface and become warm, thus keeping up the continued circulation of the waters of the great oceans. The warmth of the water of the Red Sea is due to the influx of a warm surface current from the Indian Ocean through the shallow straight of Babelmandeb and the return of a denser salt current, from excessive evaporation, along the shallow bottom and out into the Indian Ocean, thus making the entire circulation of the Red Sea to be derived from the surface warm water of a tropical ocean, and isolated from the cold polar waters flowing at the bottom of the deep oceans. Its tropical location adds the full force of the solar heat to the warm water circulation, making it the warmest of all the arms of the great oceans.

(5698) W. F. W. writes: I want to light one or two rooms by a dynamo, driven by a water motor. 1. Suppose the dynamo will light six lamps of 10 candle power each and three of them should be turned off without change of current, will the other three be injured? A. Not if the dynamo is self-regulating to a sufficient extent. But a dynamo at fixed speed only works well at its true capacity. 2. Would not lamps of 16 candle power give an 8 or 10 candle power light and last longer with this current? A. Yes; they will last longer, but cost more to run. 3. How many hours ought a low resistance lamp to give a satisfactory light with a suitable current? A. 600 hours upward. 4. Are lamps of any value after having become exhausted? A. The platinum is worth something. 5. What size wire should I use for carrying the current, the farthest lamp being about 50 feet from the dynamo? A. It depends on the amperage of the lamps, which can be deduced from the voltage and candle power. These factors you do not state. 6. If the wire is insulated in the ordinary way, is it necessary to provide any additional insulation where it passes through wood or plaster? A. Not if gutta percha insulation is used. 7. Is there any simple method for determining the number of revolutions per minute of a water motor? I wish to find the velocity of a ½ horse power motor with a water pressure of 80 pounds. A. Attach a pencil near its center of rotation. Move a paper mounted on a board in front of and touching the pencil. Keep the board moving for ten seconds and count the circles. 8. About how many gallons of water would pass through such a motor per hour? A. About 1,500 gallons. 9. In experimenting with blue prints I find that a dilute solution of ammonia will give them a very fine purple tone, but they soon change to blue or grayish blue. Can you give me any method by which I can fix and make permanent any desired ammonia tone? A. You cannot make it permanent.

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January 2, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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